SIKSHA 'O'ANUSANDHAN
(DEEMED TOBE UNIVERSITY)

COURSES OF STUDIES

FOR

M.SC. MOLECULAR BIOLOGY

2014-2015

SEMESTER SYSTEM

KHANDAGIRI SQUARE, PO- KHANDAGIRI
BHUBANESWAR – 751030
SIKSHA 'O' ANUSANDHAN (DEEMED TO BE UNIVERSITY)

FACULTY OF PHARMACEUTICAL SCIENCES SPS, SIKSHA 'O' ANUSANDHAN (DEEMED TO BE UNIVERSITY)

Program Educational Objectives (PEOs) of M.Sc. Molecular Biology Programme

1: The students will exhibit ability to pursue respectable careers in the industry, agriculture, and applied research where biological system is increasingly employed.
2: Graduates will address the increasing need for skilled scientific manpower, contributing to application, advancement, and impartment of knowledge in interdisciplinary areas of biotechnology.
3: Students will exhibit excellent professional skills, communication skills and ethical attributes as an effective team member. in a competitive global environment.
4: Graduates will demonstrate right mixes of innovative ability, equipped with entrepreneurship skills, contributing to self and national development.
5.The successful candidatess will be cognizant and responsive to the societal needs and will possess the initiative and critical acumen required to continuously improve their knowledge through life long learning.
6. To learn from every environment and become responsible, ethical and productive citizens.

Program Outcomes (POs) of M.Sc. Molecular Biology Programme

1. **Biotechnology Knowledge and Problem analysis**	Ability to identify and justify medicinal values of natural resources and to analyze the disease process and develop ways of intervention using biotechnological approach. Able to address safety, efficacy, toxicity and environmental issues of drug candidates and drug products.
2. **The Pharmacist and Society**	Ability to develop suitable drug product for better patient compliance.
3. **Research and development**	Equips capacity to build a career in academics, biotech-based industries as scientists or technocrats in the division of production, research and development.
4. Modern Tools	Demonstrate the ideas and research approach for their higher studies in molecular biotechnology and develop their scientific endeavor.
5. **Communication**	Develops expertise to analyse the justifications behind various regulatory/legal bodies governing the research and development of molecular biology associated research and development industry.
6. Lifelong Learning	Exhibit thorough application oriented knowledge to students in various emerging areas of molecular biology, so as to meet the global challenges of industry and academia.
7. Environment and sustainability	Aptitude to designs aids in developing solutions for complex problems giving due importance to the public health and safety, and the cultural, societal, and environmental considerations

Progaramme specific Outcomes (PSO)

1. Expertise in the field of Biotechnology	Understand basic and advanced concepts and techniques of Biotechnology. Gain an appreciation and knowledge of how to deal with ethical issues relating to Biotechnology**.**
2. Development of product oriented methodologies	It will enable the students to explore the possibilities of variation in cellular and molecular organizations of cells and tissues for result interpretations. This will make students to know the method of somatic embryogenesis, protoplast culture and germplasm conservation. This will make students know about the production of plant secondary metabolites through tissue culture method.
3. Invention and Entrepreneurship	Molecular cloning and characterization of unknown genes; Gene Knock-out technologies; Gene therapy and its applications; Transposons and T-DNA tagging; Gene regulation and silencing which will equip the students fit for biotechnology research and industry.
4. Pharmaceutical research and development	Understanding of the concept of protein folding and different disease associated with misfolding of protein will be helpful in employability of students in different pharmaceutical companies and research and development organizations . Experience on microbiological technique will be helpful the student to secure job in clinical, food and pharmaceutical industries. They can build career in research and development organization to serve the society.

Mapping of Program Educational Objectives (PEOs) Vs. Program Outcomes (POs)

	PO_A	PO_B	PO_C	PO_D	PO_E	PO_F	PO_G	PO_H	PO_I	PO_J	PO_K
PEO1	√	√	√	√	√	√	√				
PEO2							√		√		√
PEO3							√	√	√	√	√
PEO4	√	√	√	√	√	√	√	√			
PEO5			√			√	√	√	√	√	
PO6								√	√	√	√

Name of the Course: M.Sc. Molecular Biology

About the course

Careers in molecular biology are focused on latest developments of cell biology. Stem cell studies and its utilities are vital study lessons in molecular biology. Extensive research in molecular biology has enabled scientists and scholars to develop clones of various animals. Studies in molecular biology also have helped in studying the evolution of the living world comprising plants and animals. Molecular biology jobs are extremely focused and primarily research based. Scholars either take up educational assignments or get engaged as research candidates. Postgraduates in molecular biology get openings as lecturers; experienced candidates get opening as assistant professors and professors. Scholars successfully completing molecular biology courses get excellent openings in foreign academies and organizations. Institutes doing intensive research in cytology, stem cell studies, and genetics are always on the lookout for qualified molecular biology scholars. The 21st century post genomics era offers a wide range of job opportunities in the agricultural, medical, pharmaceutical, aquaculture, forensics and environmental science areas.

SEMESTER SYSTEM

The course comprises four semesters. One Semester = 15 weeks. Theory 1 Credit = 1hr/week. Practical 2 credit = 3hrs/week. Theory paper carries 100 marks and practical paper carries 100 marks each (Students seminar 100 marks and Project work of 100 marks will be evaluated in IV Semester). Total Credit is 90 (Ninety).

COURSE STRUCTURE

Semester –I

MB 1.1	Biochemistry	(40 Lectures / 4 Credits)
MB 1.2	Cell and Developmental Biology	(40 Lectures / 4 Credits)
MB 1.3	Molecular Biology	(40 Lectures / 4 Credits)
MB 1.4	Bioinstrumentation	(40 Lectures / 4 Credits)
MB 1.5	Practicals	(50 Classes/ 8Credits)

Semester –II

MB 2.1	Microbiology & industrial Application	(40 Lectures / 4 Credits)
MB 2.2	Molecular Virology	(40 Lectures / 4 Credits)
IBT 2.3	Biostatistics & Computer Application	(40 Lectures / 4 Credits)
MB 2.4	Genomics & Proteomics	(40 Lectures / 4 Credits)
MB 2.5	Practicals	(50 Classes / 8 Credits)

Semester-III

MB 3.1	Genetic Engineering	(40 Lectures / 4 Credits)
MB 3.2	Immunology	(40 Lectures / 4 Credits)
MB 3.3	Nanobiotechnology	(40 Lectures / 4 Credits)
MB 3.4	Bioinformatics	(40 Lectures / 4 Credits)
MB 3.5	Practicals	(50 Classes / 8 Credits)

Semester-IV

MB 4.1	Seminar Presentation	(02 Credits)
MB 4.2	Project	(16 Credits)

Total	**90 Credits**

SEMESTER-I

MB-1.1: Biochemistry **Credit 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB-1.1: Biochemistry	CO1	Students will be able to understand the structure and functions of biomolecules like carbohydrates, amino acids, proteins, lipids and nucleic acids.	1,2,3/1, 2	1,2, 3
	CO2	It will enable the students to explore the role of kinetics and inhibition of enzymes in metabolic pathways.	1,2,3/1, 2	1,2, 3

MB 1.2: Cell and Developmental Biology **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 1.2: Cell and Developmental Biology	CO1	Students will be able to find out different functions cell .	1,2,3/1, 2	1,2
	CO2	They will get the knowledge of developmental stages of embyo	1,2,3/1, 2	1,2

MB1.3: Molecular Biology **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB1.3: Molecular Biology	CO1	Describe the connection between DNA, RNA and proteins.	1,2,3/1, 2	1,2
	CO2	Explain why a change to a DNA sequence will alter ALL subsequent proteins produced from that template, while altering an RNA sequence in the same way will only alter one or a few proteins produced from that template.	1,2,3/1, 2	1,2
	CO3	Name the enzymes, organelles and molecules involved in Transcription and describe the role of each.	1,2,3/1, 2	1,2

MB 1.4: BIOINSTRUMENTATION **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
BT1.4: Bioinstrumentation	CO1	Study the role of different components and their function in biophysical techniques	3,4,5/2, 3	2,3, 4
	CO2	Understand the basic working principle of instruments for cell analysis	2,3,4/2, 3	3,4
	CO3	Utilize the bioseparation principle in life science study for it commercial application	3,4,5/3, 4	3,4

MB 1.5: PRACTICAL **Credits 08**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
BT1.5: PRACTCALS	CO1	Students will be able to understand the cellular integrity and biomolecular composition of cells and tissues at intervals of time using appropriate techniques.	2,3,4/3, 4	1,2 3,4
	CO2	It will enable the students to explore the possibilities of variation in cellular and molecular organizations of cells and tissues for result interpretations.	2,3,4/3, 4	1,2 3,4

SEMESTER-II

MB 2.1: Microbiology & Industrial Applications Credits 04

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 2.1: Microbiology & Industrial Applications	CO1	By the end of the course students will be able to develop an understanding regarding different microbes their diversity and how they become classified.	1,2,3/1, 2	1,2
	CO2	Understand the growth kinetics of different class of microbes their physiology, adaptation and evolution according to their habitat	1,2,3/1, 2	1,2
	CO3	They will also understand the host pathogen interaction of microbes, their roles in modification of earths environment	1,2,3/1, 2	1,2
	CO4	The students also will get exposed to various medically important microbes that causes disease or could be used as probiotics, moreover they will learn about vaccine development of different pathogenic microbes and about drug resistance of the same	1,2,3/1, 2	1,2

MB 2.2: Molecular Virology Credits 04

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 2.2: Molecular Virology	CO1	To understand the classification of different viruses, their structure, pathogenesis and economical losses occur by them.	2,3,4/2, 3	1,2, 3
	CO2	Genomic study and the growth of different RNA and DNA viruses.	2,3,4/2, 3	1,2, 3
	CO3	Molecular method of detection and diagnosis of different animal and plant viruses	2,3,4/2, 3	1,2, 3
	CO4	Isolation, detection of different viruses by immune assays.	2,3,4/2, 3	1,2, 3

MB 2.3: Biostatistics and Computer Applications Credits 04

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 2.3: Biostatistics and Computer Applications	CO1	The basic concepts of statistics, the need for statistical methods in research and data analysis methods in research.	2,3,4/2, 3	1,2, 3
	CO2	This part of course give idea about the fundamental theory of probability and standard distributions, tests of significance used in Statistical analysis and the different types of multivariate analysis used in research.	2,3,4/2, 3	1,2, 3
	CO3	Practical analysis of data using standard softwares like SPSS, SAS, and understanding of it in Descriptive Data Analysis, Sampling Theory, Biostatistical Inference, testing of Hypotheses, Nonparametric Methods and Multivariate Regression Analysis.	2,3,4/2, 3	1,2, 3
	CO4	Furthermore, different software based techniques to develop primer designing for particular gene, and phylogenetic tree preparation to determine the evolutionary relationship of two organism	2,3,4/2, 3	1,2, 3
	CO5	Basic idea about homology study of protein in different species and their structure determination, microarray analysis, structure determination of compound by XRay crystallography and NMR. Furthermore, molecular docking of different compounds with different biomolecules	2,3,4/2, 3	1,2, 3

MB 2.4: Genomics and Proteomics **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 2.4: Genomics and Proteomics	CO1	Familiarization of basic concept of prokaryotic and eukaryotic genome.	2,3,4/2, 3	2,3, 4
	CO2	Knowledge of genome sequencing projects of different organism and identification of organism by molecular markers.	2,3,4/2, 3	2,3, 4
	CO3	Analysis of basic characteristics and amino acid sequencing of proteins by	2,3,4/2, 3	2,3, 4
	CO4	Able to apply the concepts of high throughput genome screening for drug targets. Analysis of microarray technology and structure analysis of proteins.	2,3,4/2, 3	2,3, 4

MB 2.5: PRACTICALS **Credits 05**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 2.5: PRACTICALS	CO1	Basic knowledge of plant tissue culture and the techniques used there in.	3,4/3,4	2,3, 4
	CO2	Basic knowledge of genomics with different modern techniques like PCR, RAPD, ISSR etc.	3,4/3,4	2,3, 4
	CO3	Basic knowledge of microbiological techniques and analysis, including, isolation and maintenance of microorganism, their growth curve analysis, determination of antibiotic resistance analysis etc.	1,2,3, /3,44	2,3, 4

Semester III

MB3.1: Genetic Engineering **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 3.1: Genetic Engineering	CO1	The students will gain knowledge of tools and strategies used in genetic engineering.	4,5,6/3,4	4,5
	CO2	Understanding of applications of recombinant DNA technology and genetic engineering from academic and industrial perspective.	4,5,6/3,4	4,5
	CO3	Can extrapolate the methods for selection of recombinants and analysis of cloned genes by sequencing methods.	4,5,6/3,4	4,5
	CO4	Can use and apply the knowledge of genetic engineering in problem solving and in practice.	4,5,6/3,4	4,5

MB 3.2: Immunology **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 3.2: Immunology	CO1	The students will be able to transfer knowledge of immunology into clinical decision-making through case studies presented in class.	4,5,6,7/3,4	5,6
	CO2	Translating the Knowledge on pathogenesis of diseases and immunity towards development of disease prevention strategies.	4,5,6,7/3,4	5,6
	CO3	Contributed substantially in the vaccine development programs against chronic diseases.	4,5,6,7/3,4	5,6

MB 3.3: Nanobiotechnology **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 3.3: Nanobiotechnology	CO1	Apply the knowledge towards development of versatile nano-materials of defined applications	5,6,7/3,4	5,6
	CO2	Can able to explain the effects of quantum confinement on the electronic structure of materials at nanoscale	5,6,7/3,4	5,6
	CO3	To develop comprehensive connections of applications of nanoscience with the diagnosis of diseases, drug delivery and most modern application towards development of nano-sensors	5,6,7/3,4	5,6
	CO4	To anticipate the global technological needs and transfer them by development of product/strategy utilizing principle of nanobiotechnology	5,6,7/3,4	5,6

MB 3.4: BIOINFORMATICS **Credits 04**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
MB 3.4: Bioinformatics	CO1	Student can use and develop bioinformatics programs for comparing & analyzing biological sequence data to identify probable function.	5,6,7/3,4	3,4,5,6
	CO2	To apply and develop scripting languages codes and implement them towards the analysis of biological data.	5,6,7/3,4	3,4,5,6
	CO3	Additionally to Develop web based applications for the problems in biology.	5,6,7/3,4	3,4,5,6
	CO4	To design potential lead molecules in silico against any disease that may be explored further as a potential candidate for the drug development.	5,6,7/3,4	3,4,5,6

MB 3.5: Practical **Credits 08**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
BT 3.5 PRACTICAL	CO1	Understand the method to isolate, digest and ligate bacterial gene.	5,6,7/ 3,4	3,4,5
	CO2	Understand the principles and techniques for bacterial transformation.	5,6,7/ 3,4	3,4,5
	CO3	Perform RNA isolation and analysis.	5,6,7/ 3,4	3,4,5
	CO4	Learn to isolate industrially important microorganism and produce alcohol, antibiotics, lipase, cellulase, baker's yeast and lactic acid etc.	5,6,7/ 3,4	3,4,5
	CO5	Understand the principle and perform different immunological assays.	5,6,7/ 3,4	3,4,5

SEMESTER IV

MB 4.1 Seminar Presentation **Credits 02**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
	CO1	Explore an appreciation of the self in relation to its larger diverse social and academic contexts.	4,5,6/3, 4	4,5
	CO2	Through independent learning and collaborative study, attain, use, and develop knowledge.	4,5,6/3, 4	4,5
	CO3	Acquire, articulate, create and convey intended meaning using verbal and non-verbal method of communication that demonstrates respect and understanding in a complex society.	4,5,6/3, 4	4,5

MB 4.2Project **Credits16**

COURSE	CO	Course Outcome's	PO/ PSO	BTL
BT 4.2: PROJECT WORK	CO1	Provide (where appropriate) an analysis (for example using statistics) to define the degree of or uncertainty in the results and their possible implications.	5,6,7/ 3,4	3,4,5
	CO2	Effectively communicate the results and conclusions of the research both orally and in writing. Use a scientific writing style with clear referencing and documentation of results.	5,6,7/ 3,4	4,5,6
	CO3	Critically evaluate the quality of the project (for example strengths and weaknesses of the study), discuss findings in the context of previous literature and make suggestions for future follow-on research	5,6,7/ 3,4	4,5,6
	CO4	Produce overall conclusions that are supported by the data and summarise the project in an abstract.	5,6,7/ 3,4	4,5,6